UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF FISH-BASED BREAKFAST CEREAL USING STUFFING AND EXTRUSION METHODS

NORLELAWATI ARIFIN

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Faculty of Applied Sciences

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Abstract

This work was carried out to develop a fish based breakfast cereal using a single screw extruder with the substitution of cocoyam powder to tapioca starch. There were two types of fish used: *Sin Croaker* (or gelama) and *Shortfin Scad* (or selayang). The extruder was designed by ATO, Wageningen and manufactured by Safeworld Enterprise, Klang. The breakfast cereal, which is of salty and fishy taste, was developed to have a texture and shape that is similar to that of normal breakfast cereal in the market.

Physicochemical analysis of the starches and fishes such as composition analysis, swelling power, water solubility, amylose content and pasting characteristic were done. It was found that *sin croaker* had higher amount of protein compared to *shortfin scad,* in comparison, it was found that the result for fat content was higher for *shortfin scad.* In addition, the protein content and amylose content of cocoyam powder were found to be significantly higher than that of the tapioca starch even though the former possesses significantly lower moisture content, swelling power and water solubility than tapioca starch. There was no significant difference however, for the fat content even though cocoyam powder had slightly higher fat content compared to tapioca starch.

The breakfast cereal was produced using the sausage production method to determine the acceptability of breakfast cereal. 30%, 40% and 50% of *sin croaker* along with 0%, 20%, 30% and 50% of cocoyam powder in substitution for tapioca starch formulations were processed for this product. Results from the study indicate that a higher score was obtained when 30% and 40% of fish were used in comparison to 50% of fish. In determining the linear expansion, hardness and colour of the product, it was found that the linear expansion decreased as the percentage of cocoyam powder was increased. This also resulted in the hardness of the product to be increased as well as the colour of the product becoming darker.

Also, in determining the rheological properties of the paste, the frequency and temperature sweep of *sin croaker*-tapioca starch-cocoyam powder mixture was done. Results of the frequency sweep indicated that the value of G′ in all the mixtures increased as the frequency was increased. In addition, 20% and 30% of cocoyam powder substitution to tapioca starch was determined as the optimum range as it showed low elastic moduli. In addition, it was found that storage moduli of temperature sweep increased during the heating process to the gelatinisation point, and gradually to decrease after the gelatinisation temperature indicate the deformation of starch granule. The G′ values of temperature sweep during cooling were also found to be decreased after certain temperature as a result the formation of homogenous network structure of the final gel. Moreover, the substitution of cocoyam powder to tapioca starch was found to indicate an increase of tan δ during heating and cooling as the substitution of cocoyam powder produced weak gel. However, as a result of the lower value of tan δ indicates strong gel.

Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

In the event that my thesis be found to violate the conditions mentioned above, I voluntarily waive the right of conferment of my degree be subjected to the disciplinary rules and regulations of Universiti Teknologi MARA.

Name of Candidate	Norlelawati Arifin
Candidate's ID No.	2002202201
Programme	Master of Research (Science)
Faculty	Applied Sciences
Thesis Title	Development of Fish-Based Breakfast Cereal Using Stuffing and Extrusion Method

Signature of Candidate .....

Date 26/6/06

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CHAPTER 1

INTRODUCTION

Breakfast, which is usually consumed early in the morning, is popularly referred to as the most important meal of the day. Studies have also indicated that people who are starting the day with light meal has more positive attitude, are slimmer and concentrate better (Wyatt et al., 2002). As such the largest market for breakfast cereal products is for the ready-to-eat (RTE) varieties such RTE breakfast cereals are defined as processed grain formulations suitable for human consumption without further cooking (Fast, 1987). Consumer popularity of ready to eat (RTE) cereal types is due to the minimal time required to prepare these products.

On the other hand, extrusion of foods is an emerging technology, which enables food industries to process and market a large number of products of varying size, shape, texture and taste (Kinsella, 1978; Harper, 1979, 1981). Extrusion cooking combines the heating of food products with the act of extrusion to create a cooked food product having any desired shape. Among the latest improvement in the extrusion technology lies in the use of the extruder as a high temperature, short-time bioreactor (Linko, 1989; Bhattacharya, 1992). The most important functions of these extruders include precooking and gelatinisation of starch, providing a desired shape to the product and giving the food an expanded, crisp, porous, and pleasing character.

Currently, there are two types of cooking–extruders available on the market: single and twin screw extruders. The main difference between the single and twin-screw extruders is the number of screw that can be found inside the barrel. The advantages of using the extruders include achieving high productivity in a single processing step and can be used to cook and form. It is also cost effectiveness, able to handle a wide variety of raw